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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/200,495	11/25/1998	PETER C. VAN BUSKIRK	2771-337(PC8	4898

7590 09/30/2002

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EXAMINER

HU, SHOUXIANG

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 09/30/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/200,495

Applicant(s)

VAN BUSKIRK ET AL.

Examiner

Shouxiang Hu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 August 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 40-55 and 61-63 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 40-55 and 61-63 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Withdrawal of the Previous Final Rejection

1. The dates of acts relied on to establish diligence as provided in the affidavit of Paper No. 20 meet to the diligence requirement set forth in MPEP § 715.07(a). And, this affidavit and the declaration of Paper No. 16 effectively show that the instant invention occurred at a time prior to the effective date (July 29, 1998) of the primary reference of Inoue (US Patent 6,300,212; which does not claim the invention of a product) cited in the final rejection of Paper No. 15. Accordingly, the final rejection of Paper No. 15 is hereby withdrawn. And, a new final rejection is set forth below (note: all claims examined in this Office action are the ones presented by applicant in Amendment D (Paper No. 17) filed on May 06, 2002).

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 40-55 and 61-63, as being supported by Applicant's elected species, are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for preventing oxygen deficiency in the surface region of the ferroelectric or high ϵ material", does not reasonably provide enablement for the subject matters that "the electrode layer does not contain oxygen abstracted from the thin film of ferroelectric

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or high ϵ material underneath” and that “the ferroelectric or high ϵ material “is stoichiometrically satisfied in oxygen content.”

Claims 40 and 63 recite the subject matter (A) that “the electrode layer does not contain oxygen abstracted from the thin film of ferroelectric or high ϵ material underneath”. However, as admitted in the specification (pages 3-4), the ferroelectric or high ϵ material tends to lose oxygen during the deposition of the top electrode layer. Although the net loss of oxygen could be reduced or even eliminated by forming the top electrode layer in an oxygen-rich environment as disclosed in the instant invention, it does not mean that there would be no even a single oxygen atom (or ion) being lost from the ferroelectric or high ϵ material and ended up in the top electrode layer during its deposition. In the dynamic equilibrium (or unequilibrium) process during the formation of the top electrode layer, there are oxygen elements (or ions) moving up and there are oxygen elements (or ions) moving down in a microscopic point of view, even though the net movement of oxygen elements may be overwhelmingly only in one of the directions. Accordingly, the recited subject matter (A) is not enabled by the disclosure, as the method of forming the top electrode layer in an oxygen-rich environment as disclosed in the instant application can only “tend to prevent a net loss of oxygen in the surface of the ferroelectric or high ϵ material” (see page 12, lines 13-15 in the specification), or lead to a “decreased tendency for the ferroelectric or high ϵ material to lose oxygen during TE deposition” (see 13, lines 13-14), or “minimize oxygen loss from the surface” (see page 13, lines 17-18 in the specification), instead of completely preventing

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individual oxygen elements (or ions) from being abstracted from the ferroelectric or high ϵ material to the top electrode.

Moreover, Claims 40 and 63 further recite the subject matter (B) that the ferroelectric or high ϵ material "is stoichiometrically satisfied in oxygen content", but it is not enabled by the disclosure either, as the term of "stoichiometrically satisfied in oxygen content" can be interpreted as meaning "stoichiometrically with no more and no less oxygen content", i.e., which requires no oxygen deficiency and no excess oxygen as well. The disclosure fails to adequately disclose how the potential excess oxygen in the ferroelectric or high ϵ material could be avoided with the method of forming the top electrode layer in an oxygen-rich environment, although the method of forming the top electrode layer as disclosed in the instant invention might be able to prevent oxygen deficiency in the underlying ferroelectric or high ϵ material.

4. Claim 63 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 63 recites the subject matter of a bottom electrode layer formed of a material selected from the group consisting of Ir, Ir oxide, Rh, Ph oxide, and compatible mixtures and alloys thereof; but adequate support for this subject matter is not found in the original disclosure.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

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The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 40-55 and 61-62 are rejected to as claim 40 recites the limitation of "the thin film" (line 5). There is insufficient antecedent basis for the limitation in the claims.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

8. Claims 40-44, 46, 47 and 49-55, insofar as being in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 102(e) as being anticipated by Nishioka ("Nishioka"; 5,973,911).

Nishioka disclose a microelectronic device structure (Figs. 3-6), comprising: a top electrode layer (6; Pt, Ir, or Ir oxide, see col. 4, lines 23-26) on a ferroelectric oxide film (5 or 9; PZT or BST). Nishioka further discloses that the ferroelectric film approaches

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becoming a perfectly structured BST film after forming the top electrode by eliminating oxygen holes or deficiency through sufficient oxygen annealing (see col. 3, lines 1-31).

It is noted that, according to the common understanding in the art, the stoichiometric oxygen requirement is normally inherently met substantially in an oxide material including its top surface region when it is perfectly structured, as it inherently substantially contains no oxygen defects or deficiency.

Regarding the limitations recited in claims 52-55 on how the top electrode is made, these limitations are process limitation that would not carry patentable weight in those claims drawing to a structure, because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985).

9. Claims 40, 46 and 50-52, insofar as being in compliance with 35 U.S.C. 112, are further rejected under 35 U.S.C. 102(e) as being anticipated by Al-Shareef et al. ("Al-Shareef"; 6,191,443).

Al-Shareef discloses a microelectronic device structure (Fig. 1; also see col. 3, lines 51-62), comprising: an Ir oxide top electrode layer (20) on a high ϵ material (18; Ta oxide).

It is noted that, the Ta oxide high ϵ material including its top surface region in Al-Shareef is inherently without oxygen deficiency, since the overlying top electrode is formed in an oxygen containing environment (see col. 3, lines 53 and 54).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 45, 48 and 61-63, insofar as being in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishioka ("Nishioka"; 5,973,911) in view of Desu et al. ("Desu"; 5,807,774) and/or Park et al. ("Park"; 5,892,254)

The disclosure of Nishioka is discussed as applied to claims 40-44, 46, 47 and 49-55 above.

Although Nishioka does not expressly disclose that the ferroelectric material can also be formed of strontium bismuth tantalite and/or that the top electrode can also be formed of Pt oxide, Rh or Rh oxide, one of ordinary skill in the art would readily recognize that strontium bismuth tantalite is one of the commonly used ferroelectric materials for forming a high dielectric constant capacitor, and that each of Pt oxide, Rh and Rh oxide can be used for the top electrode in a ferroelectric capacitor structure for achieving stable capacitor performance, as evidenced in Desu (see col. 4, lines 15-16 and 20-26) and Park (see col. 1, lines 36-41).

Therefore, it would have been obvious to one of ordinary skilled in the art at the time the invention was made to make the microelectronic device of Nishioka with the ferroelectric material being formed of strontium bismuth tantalite and/or the top

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electrode being made of Pt oxide, Rh or Rh oxide, as taught in Desu and/or Park, so that a the microelectronic device with desired material choice and stable capacitor performance would be obtained.

In addition, regarding claim 63, it is further noted that Ir oxide and Rh oxide are both art-recognized materials for a bottom electrode layer, as evidenced in Desu (see col. 3, lines 64-66).

12. Claims 40, 41, 45-47, 52 and 55, insofar as being in compliance with 35 U.S.C.112, are further rejected under 35 U.S.C. 103(a) as being unpatentable over Baum et al. ("Baum"; 5,783,716; of record).

Baum discloses a microelectronic device structure (see col. 5, lines 21-48), comprising: a Pt layer formed through oxygen-incorporated CVD on a capacitor dielectric layer in a DRAM device.

Although what in col. 5, lines 21-48, in Baum does not explicitly disclose that such a capacitor dielectric layer can be strontium bismuth tantalite, Baum does teach that strontium bismuth tantalite is a desirable material for a DRAM device and that it is desirable to form a Pt electrode in a DRAM device through a CVD process (see col. 1, lines 22-40).

Therefore, it would have been obvious to one of ordinary skilled in the art at the time the invention was made to make the microelectronic device of Baum with the capacitor dielectric layer being formed of strontium bismuth tantalite, so that a microelectronic device with desired capacitor performance would be obtained, per the

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further teachings of Baum. And, it is noted that, oxygen deficiency in such an underlying capacitor dielectric layer including its surface region would be inherently prevented from happening, due to the incorporated-oxygen environment during the CVD process in Baum.

Response to Arguments

13. Applicant's arguments in amendment C filed on 11/27/01 have been fully considered but they are not persuasive.

Applicant's main arguments include that Nishioka does not teach the claimed invention of the instant application, because the top electrode in Nishioka contains oxygen content abstracted from the underlying ferroelectric layer. In response, as noted in the claim rejections set forth above in this Office action under 35 U.S.C. 112, the original disclosure does not reasonably provide enablement for the recited limitation regarding the subject matter that "the electrode layer does not contain oxygen abstracted from the thin film of ferroelectric or high ϵ material underneath" as recited in claims 40 and 63. Therefore, such unenabled subject matter carries no patentable weight to the claims rejected above in this Office action under 35 U.S.C. 102 and/or 103.

#14 #17

Applicant's other arguments (in both amendment C and amendment D) with respect to claims 40-55 and 61-63 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

^{#14}
14. Applicant's amendment filed on 11/27/01 necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706:07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is (703) 306-5729. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A handwritten signature in cursive script, appearing to read "Shouxiang Hu".

SH

September 25, 2002